

10672711_CLS1.txt

Most Frequently Occurring Classifications of Patents Returned
From A Search of 10672711 on June 14, 2005

original classifications

2 257/301
2 433/223

Cross-Reference Classifications

3 365/185.17
3 365/201
3 714/721
2 257/332
2 257/E27.084
2 257/E27.092
2 257/E27.112
2 365/170
2 365/185.12
2 365/185.22
2 711/112
2 711/117

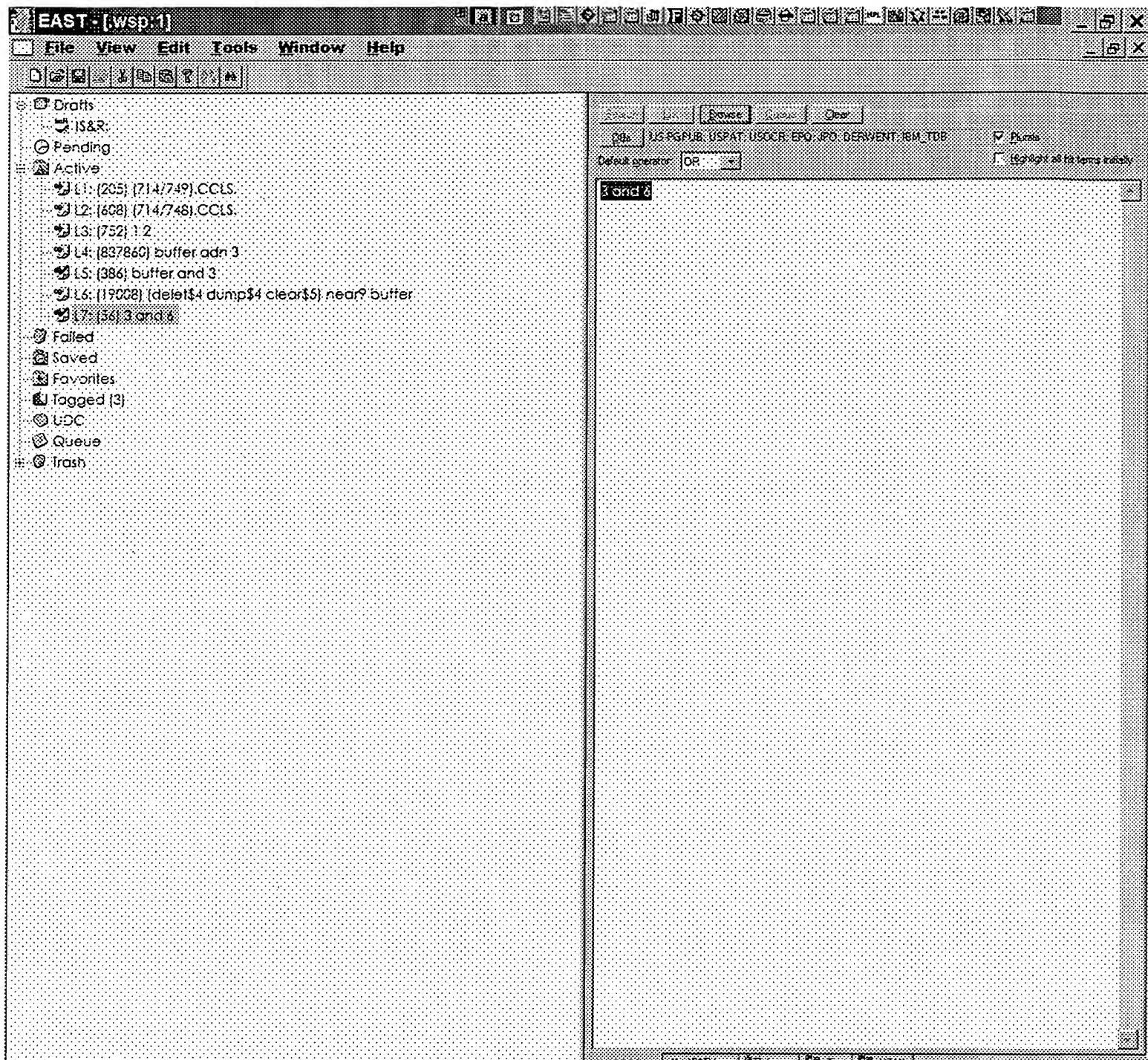
Combined Classifications

4 365/185.17
3 365/185.22
3 365/201
3 714/721
2 257/301
2 257/332
2 257/E27.084
2 257/E27.092
2 257/E27.112
2 365/151
2 365/158
2 365/170
2 365/185.12
2 365/200
2 433/223
2 711/112
2 711/117
2 711/162
2 712/22

714/748, 18

370/428, 420, 229, 329

711/114, 111, 107



U	Document ID	Issue Date	Pages	Title	Current Off	Current XRef	Retrieval Class
1	US 20050254508 A1	20051117	15	Cooperation between packetized data bit-rate adaptation and data	370/428	370/252; 714/748	Aksu, Enr
2	US 20050210355 A1	20050922	20	Retransmission ordering method for wireless communication system	714/748		Hoh, Kats
3	US 20050172197 A1	20050804	15	Adaptive rate code combining automatic repeat request (ARQ)	714/748		Chamber
4	US 20040184471 A1	20040923	13	Transmission methods for communication systems supporting a	370/420	714/748	Chuan, M
5	US 20040071108 A1	20040415	7	Flow control in a radio access network	370/328	370/230; 370/338	Wigell, To
6	US 20030169697 A1	20030911	25	Method of flow control for data transported using isochronous packets	370/229	370/389; 370/479	Bardini, Ri
7	US 20030159099 A1	20030821	7	Negative acknowledgment (NAK) suppression	714/749	714/750	Vukovic,
8	US 20030086403 A1	20030508	13	Method for dynamically adjusting the	370/338	370/349	Hans, Jo



US06587935B2

(12) **United States Patent**
Ofek

(10) Patent No.: **US 6,587,935 B2**
(45) Date of Patent: **Jul. 1, 2003**

(54) **METHOD AND APPARATUS FOR MIRRORING DATA IN A REMOTE DATA STORAGE SYSTEM**

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(73) Assignee: EMC Corporation, Hopkinton, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 10/229,233

(22) Filed: Aug. 27, 2002

(65) Prior Publication Data

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Related U.S. Application Data

(63) Continuation of application No. 09/257,734, filed on Mar. 13, 1999, now Pat. No. 6,477,427, which is a continuation-in-part of application No. 08/637,760, filed on May 31, 1996, now Pat. No. 5,933,653.

(51) Int. Cl. **G06E 12/00**

(52) U.S. Cl. **711/162**

(58) Field of Search **711/162, 161, 709/234, 370/232**

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,742,792 A	4/1998	Yacai et al.	711/162
5,802,310 A	9/1998	Rajaraman	709/234
5,987,566 A	11/1999	Vishwanath et al.	711/114
6,044,444 A	3/2000	Ofek	711/162
6,173,377 B1	1/2001	Yacai et al.	711/162

* cited by examiner

Primary Examiner—Do Hyun Yoo

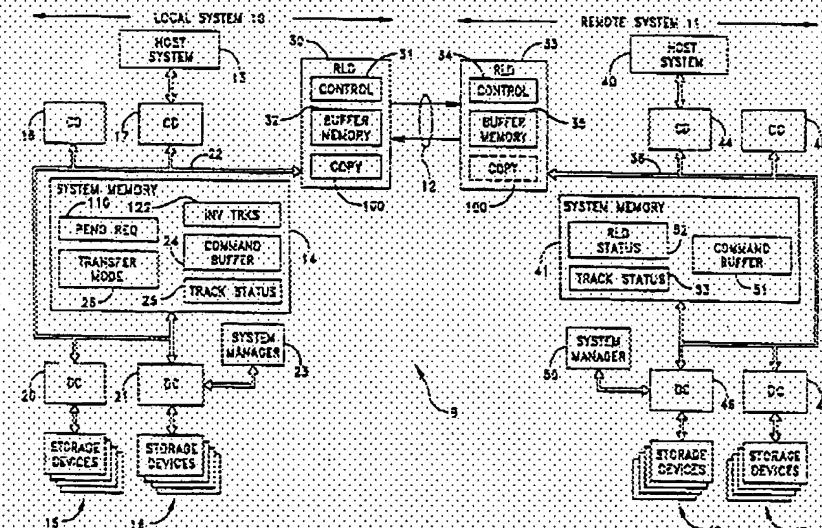
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(57) **ABSTRACT**

A data processing network including a local system and a geographically remote system. Each of the local and remote systems includes a data storage facility. The remote data storage facility mirrors the local data storage facility. In a normal operating mode, the local and remote systems operate in near synchronism or in synchronism. In an alternate operating mode, writing operations at the local system immediately update the storage devices in the local data storage facility. Transfers of corresponding data to the remote data storage facility are made independently of and asynchronously with respect to the operation of the local system.

21 Claims, 11 Drawing Sheets



US-PAT-NO 6587935

DOCUMENT-IDENTIFIER: US 6587935 B2

TITLE: **Method and apparatus for mirroring data in a remote data storage system**

KINIC

US Patent No.: PN (1)
6587935

Detailed Description Text

DET X (1)

As will become apparent later, the alternate operating mode can be implemented with either of two procedures and that the alternate operating mode can be controlled so it operates only under certain conditions or constraints.

The first is an "ADAPTIVE COPY/WRITE PENDING" procedure. Step 66 determines whether this procedure was being processed and interrupted to return to the

SYNC operating mode. If it was, step 67 determines whether the number of write requests pending for the remote system are above a maximum. If they are not

system operation advances to FIG. 2D and returns to the ADAPTIVE COPY/WRITE PENDING operating mode. Otherwise the system transfers to await an acknowledgement signal in step 71. The other alternating operating mode is an

"ADAPTIVE COPY/DISK" operating mode. Step 71 determines whether the requested SYNC operation has been initiated by interrupting such an ADAPTIVE COPY/DISK operating mode. If it has, the system tests the number of invalid tracks

listed in the TRACK STATUS table 20 of FIG. 1. If the number of marked tracks are above a maximum, step 72 transfers to step 70. Otherwise control transfers to the steps in FIG. 2E and returns the operators to the ADAPTIVE COPY/DISK operating mode.

Detailed Description Text

DET X (3)

As will be apparent, in this mode data transfers from the local system (10) to the remote system (11) but the local system (10) does not wait for the receipt of any acknowledgement or synchronization from the remote system (11). This mode is especially useful when a large amount of data must be transferred to remote devices and performance is not

U	I	Document	Issue Date	Pa	Current Cl	Current XR	Title
20	<input type="checkbox"/>	US 5379379	1995010	24	711/3	711/158	Memory control unit with self Dynamic hierarchical association
21	<input type="checkbox"/>	US 5341483	1994082	85	711/206		Interface and process for hi
22	<input type="checkbox"/>	US 6363466	2002032	12	711/169	710/112	Multi-channel DMA with sch
23	<input type="checkbox"/>	US 6738881	2004051	25	711/168	370/329	Spin-wheel SDRAM access
24	<input type="checkbox"/>	US 6725347	2004042	18	711/167	710/52	Methods and apparatus for
25	<input type="checkbox"/>	US 2003020	2003103	12	711/164	711/154	Unified data sets distributed
26	<input type="checkbox"/>	US 2002015	2002101	30	711/162	711/114	Unified data sets distributed
27	<input type="checkbox"/>	US 6662282	2003120	30	711/162	711/111	Method and apparatus for m
28	<input type="checkbox"/>	US 6587935	2003070	20	711/162	700/234	Method and apparatus for m
29	<input type="checkbox"/>	US 6477627	2002010	20	711/162	700/234	Method and apparatus for m
30	<input type="checkbox"/>	US 6587935	2003070	20	711/162	700/234	Method and apparatus for m